

REMARKS/ARGUMENTS

Applicant has amended Claims 11 and 16 to clarify that the at least one chemical selected from the group consisting of said ferrous ion or compound supplying ferrous ion, said catalase, and said iodine or a compound supplying iodine, when added, is added to the ship ballast water at the indicated concentration (Claim 11) and is diluted or dissolved with seawater or fresh water and added to the ballast water (Claim 16). New dependent Claims 26-28 respectively require the addition of: ferrous ion or a compound supplying ferrous ion and catalase (Claim 26); ferrous ion or a compound supplying ferrous ion and iodine or a compound supplying iodine (Claim 27); and catalase and iodine or a compound supplying iodine (Claim 28). Support for the amended and new claims can be found in the phrase “at least one type selected from a ferrous ion or a compound supplying ferrous ion, catalase and iodine or a compound supplying iodine” in the Specification at page 4, line 26, to page 5, line 17, page 8, lines 1-10, original Claim 1, and previously presented Claim 10. Support for “simultaneously” adding the hydrogen peroxide component and catalase in currently amended Claim 22 is found at page 10, lines 23-28, of the Specification.

No new matter has been added.

Rejections under 35 U.S.C. 112, 2<sup>nd</sup> ¶

Claims 11 and 16 were rejected under 35 U.S.C. 112, 2<sup>nd</sup> ¶, as vague and indefinite, because the Examiner concluded that the claims can be given two mutually exclusive constructions (Office Action dated December 22, 2008 (OA), p. 2). Because of the use of Markush language in Claim 10, the Examiner concludes that persons having ordinary skill in the art would not be able to determine from the claim language itself whether or not any one or all of the active species recited in method Claims 11 and 16 is added to the ship ballast water as claimed. In clarification, method Claim 11 now expressly states that hydrogen peroxide is added such that its concentration in the ship ballast water is 10 to 300 mg/L, said

ferrous ion, when added, is added such that its concentration in the ship ballast water is 0.1 to 100 mg/L, said catalase, when added, is added such that its concentration in the ship ballast water is 0.5 to 250 unit/L, and said iodine, when added, is added such that its concentration in the ship ballast water is 0.1 to 10 mg/L. Furthermore, method Claim 16 now states that hydrogen peroxide or a compound producing hydrogen peroxide and said at least one chemical selected from the groups consisting of said ferrous ion or a compound supplying ferrous ion, when added to the ship ballast water, said catalase, when added to the ship ballast water, and said iodine or a compound supplying iodine, when added to the ship ballast water, are diluted or dissolved with seawater or fresh water and are added to the ballast water.

Given the amendments to Claims 11 and 16, the language of the claims now makes clear that the concentration of each active ingredient and the medium in which it is added to ship ballast water is as specified in the claims when that active ingredient is added. Accordingly, the Examiner's rejections under 35 U.S.C. 112, 2<sup>nd</sup> ¶, should be withdrawn.

#### Claim interpretation

Certain features of the method Applicant claims must be emphasized. First, the claims are directed to a methods for treating ship ballast water which comprise "adding the active ingredients to the ship ballast water". Ship ballast water is present in the closed environment of the ship's ballast. Accordingly, persons having ordinary skill in the art would have understood that adding active ingredients to the ship ballast water involves adding active ingredients to water which is not being circulated, aerated, ventilated, or otherwise continuously exposed to an oxygen atmosphere.

Second, the method Applicant claims requires addition of hydrogen peroxide or a compound for producing hydrogen peroxide (hereafter HP) and at least one chemical selected from the group consisting of ferrous ion or a compound supplying ferrous ion (Fe), catalase, and iodine or a compound supplying iodine such that (1) "organisms viable in the ship ballast

water are exterminated” (emphasis added) and (2) “the concentration of dissolved oxygen in the ship ballast water is maintained at a level viable to said organisms [viable in the ship ballast water]” (emphasis added). Unless the scope and content of the method Applicant claims is fully understood, the distinctions between the method Applicant claims and the prior art methods may not be readily apparent.

Egusa’s teaching

Egusa (U.S. Patent 5,256,423, issued October 26, 1993) describes a method for destroying cysts of noxious plankton in ship ballast water by adding HP to the ship ballast water at a concentration (10-500 ppm) and for a time (3-48 hours) sufficient to destroy cysts of noxious plankton. See Egusa, Claims 1-9.

Rejection under 35 U.S.C. 103 over Egusa in view of Ikuta

Claims 10-13 and 16-21 stand rejected over Egusa in view of Ikuta (Biofouling Control Using a Synergistic Hydrogen Peroxide and Ferrous Ion Technique, 49<sup>th</sup> Annual Meeting, International Water Conference, 1998)(OA, p. 3). The Examiner finds that Ikuta describes a method for preventing befouling of the seawater cooling system of fossil and nuclear power plants which comprises adding HP and ferrous ion to the seawater circulating through their cooling systems (OA, pp. 3-5). Ikuta added the chemicals continuously to the circulating seawater in the cooling systems for 24 hours a day at concentrations of HP from 0.25-1.4 ppm and concentrations of Fe of 0.1-0.25 ppm (Ikuta, p. 449, col. 1-2). Fouling organisms were reduced after circulating a combination of HP and Fe through 60 meter long pipes of the cooling systems at a flow velocity of 0.1 m/s and taking samples at 10 minute intervals (Ikuta, p. 450, col. 1, Duration Study). Ikuta teaches that *Bryozoa* constituted 47.9% of the fouling organisms and colonial tunicates, mussels, tube-dwelling *polychaetas*, and *malacostracas* constituted the rest (Ikutam p, 449, col. 1). *Bryozoa* and colonial tunicates in the cooling system decreased, hydroids stayed the same or decreased depending on the

concentration of active agents, sponges and barnacles increased, barnacles exhibited no growth, and the average growth of mussels decreased (Ikuta, p. 449, col. 2, to p. 450, col. 1). Based on that evidence, Ikuta informs persons having ordinary skill in the art that fouling organisms of the cooling system of a power plant were controlled effectively (Ikuta, p. 450, col. 1). Thereafter, Ikuta conducted experiments in the heat exchangers of a power plant for up to 3 months (Ikuta, p. 450, cols. 1-2). The evidence indicated a reduction in the growth, number, and settling of some fouling organisms and no reduction in the growth, number, and settling of others. The results for barnacles and mussels appeared to be inconclusive (Ikuta, p. 450, col. 2). Ikuta teaches that the combination of HP and Fe had a synergistic effect on “control of mussels” in certain locations in the cooling pipes but did not affect the organisms already settled in other locations (Ikuta, p. 451, col. 1). Growth of *Obelia sp.* was not affected at all (Ikuta, p. 451, col. 1). Ikuta concluded from the evidence that fouling organisms in circulating cooling systems can be “controlled synergistically” by HP and Fe. However, and significantly, Ikuta would not have taught persons having ordinary skill in the art that organisms viable in the ship ballast water would be exterminated as Applicant’s claimed method requires. In fact, Ikuta appears to teach that full grown organisms are unaffected by the combination of HP and Fe (Ikuta, p. 451, col. 1).

Moreover, the cooling systems of a power plant with its inlet and outlet pipes and continuous flow of cooling seawater appears to be an active flow system either open to oxygen, subject to aeration, or never fully depleted of oxygen (Ikuta, p. 451, col. 1). In the continuous flow cooling system of a power plant, there appears to be no need to maintain the concentration of oxygen at a level viable to organisms. In fact, the oxygen levels appear to be optimum for the growth fouling organisms (Ikuta, p. 451, col. 1).

Rejection under 35 U.S.C. 103 over Egusa in view of Kozo

Claims 10, 14, and 22 stand rejected under 35 U.S.C. 103 over Egusa in view of Kozo (JP 01-94997, published April 13, 1989)(OA, p. 5-6). The Examiner finds that Kozo teaches the combination of HP and catalase for preventing fouling by marine organisms (OA, p. 5). Applicant finds that Kozo describes a method of preventing fouling by marine organisms using HP and catalase. However, Kozo teaches that HP and catalase are not to come in contact with each other prior to injection because “the catalase will decompose the hydrogen peroxide. It is therefore important to add both chemicals separately by two-liquid injection.” (Kozo, p. 2, col. 1, ll. 11-16). Kozo instructs, “When the present invention is practiced, sequential injection using a combination of hydrogen peroxide and catalase is effective as a method of feeding chemicals.” *Id.* (emphasis added). To the contrary, Applicant’s claimed method comprises addition, and currently amended Claim 22 comprises simultaneous addition, to non-circulating ship ballast water of both (1) hydrogen peroxide or a compound producing hydrogen peroxide in an amount such that a hydrogen peroxide concentration in the ship ballast water is 10 to 500 mg/L, and (2) catalase in an amount such that a concentration of catalase in the ship ballast water is 0.5 to 2,500 unit/L. The HP and catalase are simultaneously used to exterminate organisms viable in the ship ballast and maintain the concentration of dissolved oxygen in the ship ballast water at a level viable to said organisms. Applicant expressly states (Spec., p. 10, ll. 23-28; emphasis added):

Further, the amount to be added of at least one type selected from the ferrous ion, catalase and iodines to be simultaneously used may be defined on the basis of the amount capable of decomposing the thus-added hydrogen peroxides at the time of discharging the ship ballast water while taking into consideration maintaining a dissolved oxygen concentration in the ship ballast water during navigation.

Thus, persons having ordinary skill in the art reasonably would not have sought to mix HP and catalase in the ship ballast water because Kozo teaches that by so doing the HP will decompose.

Moreover, like Ikuta, Kozo is interested in preventing fouling of the circulating seawater cooling systems of power plants and the like by marine organisms such as mussels, barnacles, hydrozoans, etc.. In circulating systems, sequential addition of HP and catalase would appear acceptable. The two additives are not mixed together when added to circulating seawater. However, ship ballast water does not circulate. Persons having ordinary skill in the art reasonably would not have expected to add catalase to HP in ship ballast water, or vice versa, without decomposing the HP. Applicant is not concerned with exterminating marine organisms or maintaining a concentration of dissolved oxygen in the circulating seawater of a cooling system. Kozo seeks to prevent blockage of the flow of cooling seawater caused by organisms settling in the pipes, channels, and heat exchangers (Kozo, p. 1, col. 1, l. 20, to col. 2, l. 7). Only Applicant seeks to exterminate organisms and still maintain the oxygen concentration in non-flowing ship ballast water at a level viable for the organisms.

Nor is Kozo concerned with maintaining the dissolved oxygen concentration in a sealed system. Kozo's circulating seawater cooling systems do not appear to be subject to oxygen depletion.

In short, persons having ordinary skill in the art would not have been led by the combined teachings Egusa and Kozo to simultaneously add HP and catalase to ship ballast water to exterminate organisms therein and maintain oxygen concentrations at levels suitable for dumping in foreign waters without damaging the ecosystems. Kozo warns persons having ordinary skill in the art to refrain from allowing catalase to decompose the HP. To the contrary, Applicant intends to kill organisms in ship ballast water and yet maintain the dissolved oxygen content of ship ballast water at a level suitable for dumping the water into the surrounding environment.

The Examiner will note that currently amended Claim 22 requires simultaneous addition of HP and catalase to the ship ballast water. The method of currently amended Claim 22 is not open to sequential addition. The Examiner's rejection of claims 10, 14, and 22 should be withdrawn.

Rejection under 35 U.S.C. 103 over Egusa in view of Keisuke

Claims 10, 15, 23, and 24 stand rejected under 35 U.S.C. 103 over Egusa in view of Keisuke (JP 2002-086155, published March 26, 2002)(OA, p. 6). The Examiner states (OA, p. 6):

Keisuke teaches using peroxide in addition to a source of iodide ions to produce hypiodous acid inexpensively and safely to sterilize a water system (. . . Keisuke [0021] 20 mg/L is contemplated). The use of hypiodous acid is inexpensive and prevents metal corrosion, also pH changes in the water do not affect sterilizing activity . . . . Therefore, it would have been obvious . . . to add iodide ion source to the method of peroxide treatment in Egusa to produce hypiodous acid . . . .

The Examiner acknowledges (OA, p. 8), "[T]he combination of Keisuke with Egusa does not teach within the ranges claimed. [A]s to the relative concentrations of peroxide and iodine, claim 10 allows for the stoichiometric excess found in . . . [Keisuke] by covering large ranges for the amounts of peroxide and iodide." Applicant is confused by the Examiner's analysis of Keisuke's teaching and its relationship to the method claimed. Persons having ordinary skill in the art would not conclude that the method Applicant claims would have been obvious in view of the combined teachings of Egusa and Keisuke.

As previously stated, Keisuke describes a solution of hypiodous acid for use in sterilizing various systems (Keisuke [0001-0002; 0007]). The hypiodous acid sterilization solution is prepared by mixing (1) a solution of iodide ions, and (2) a solution of peracetic acid or hydrogen peroxide (Keisuke [0008]). Keisuke instructs that the molar concentration of peracetic acid or hydrogen peroxide should be low compared to the molar concentration of iodide in order to generate hypiodous acid efficiently (Keisuke [0023; 0028]). "[I]t is preferred to use . . . hydroiodic acid in excessive amount to hydrogen peroxide" (Keisuke

[0029]). Keisuke seeks to drive the reactions between iodide and HP to completion because the presence of unreacted hydrogen peroxide can corrode metal drainage systems, can be dangerous, can decompose the desired hypiodous acid, does not improve the germicidal activity of the mixture, and should be avoided (Keisuke [0024; 0029]).

Keisuke teaches that the reaction of hydrogen peroxide and an iodide advances in a relatively short time (Keisuke [0030]). The concentration of hypiodous acid generated when hydrogen peroxide is added increases rapidly, i.e., maximum generation of hypiodous acid occurring in about 5 minutes, and gradual decomposition of hypiodous acid and decreased bacteriacidal effect results thereafter (Keisuke [0030]). Keisuke does not want excess unreacted peracetic acid or hydrogen peroxide in its systems because unreacted peracetic acid or hydrogen peroxide corrode metal drainage systems, are dangerous, decompose the desired hypiodous acid, and does not improve the germicidal activity of the mixture.

Keisuke mixes minor amounts of peroxide to major amounts of iodide ion to produce an hypiodous acid sterilizing solution. Moreover, the sterilizing solution is applied in open air atmospheres where depletion of dissolved oxygen is never a problem. Keisuke expressly states that hydrogen peroxide concentrations are to be avoided for reasons including metal corrosion, decomposition of the active agent, and loss of biocidal activity. When hydrogen peroxide is added to iodide ion, hydrogen peroxide reacts quickly with the iodide ion, the hydrogen peroxide concentration in the mixture is diminished, and the biocidal activity of the mixture lasts for no more than 5 minutes.

Given that the initial concentration of peracetic acid or hydrogen peroxide in Keisuke's sterilization mixture starts at no more than 25 mg/l and decreases to zero rapidly, persons having ordinary skill in the art reasonably would not have considered adding iodide ions to the hydrogen peroxide solutions Egusa employs to treat ballast water. Keisuke's



sterilization solutions exclude the unreacted hydrogen peroxide concentrations both Egusa's and Applicant's claimed method require.

Egusa and Applicant treat ballast water in a closed system, i.e., the ship ballast. Keisuke has no interest in maintaining the oxygen levels in water in a closed system or adding sufficient unreacted hydrogen peroxide concentrations to do so. Keisuke is not concerned with maintaining biocidal activity for periods more than about 5 minutes. Keisuke is not concerned with the environmental consequences of dumping large excesses of disinfectant into an ecosystem. Accordingly, persons having ordinary skill in the art reasonably would not have been led by Keisuke's disclosure to add iodide to the hydrogen peroxide solutions Egusa uses to treat ship ballast water. The Examiner's rejections under 35 U.S.C. 103 over Egusa in view of Keisuke fairly should be withdrawn.

Kozo and Ikuta do not teach extermination of marine microorganisms and do not teach extermination of any organisms shown to be present in ship ballast water. Keisuke and Kozo either do not or cannot maintain concentrations of hydrogen peroxide sufficient to treat ballast water. Ikuta and Kozo merely control the growth, growth rate, and settlement of mussels and barnacles which tend to block the pipes of circulating cooling systems. Keisuke employs hydrogen peroxide and iodide ions to prepare and apply hypiodous acid disinfectant solutions. Unreactive peroxides are eliminated from, and preferably kept out of Keisuke's disinfectants because they damages metal systems, decompose the active hypiodous acid component in the disinfectants, and reduce the biocidal function of the disinfectant. The stability, contact time, and component concentrations essential for Applicant's claimed method of treating ship ballast water with hydrogen peroxide in the presence of iodine ions, catalase, and/or ferrous ion to exterminate organisms viable in ship ballast water and maintain the concentration of dissolved oxygen in ship ballast water at a

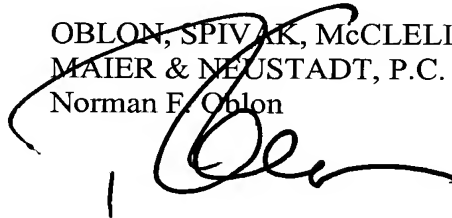
level viable to said organisms is not reasonably suggested by any of the references combined with Egusa.

Moreover, the methods of new Claims 26-28 require the addition of at least two of the "other" chemicals added to ship ballast water along with HP or a compound producing HP. No combination of the applied references further would have taught a person having ordinary skill in the art that the activity, stability, contact time, and concentration of unreacted HP added to ship ballast water would be sufficient to exterminate harmful organisms and maintain a viable concentration of dissolved oxygen in the ship ballast water in the presence of at least two reactive chemicals selected from the groups consisting of (a) ferrous ion or a compound supplying ferrous ion in an amount such that a ferrous ion concentration in the ship ballast water is 0.1 to 400 mg/L, (b) catalase in an amount such that a concentration of catalase in the ship ballast water is 0.5 to 2,500 unit/L, and (c) iodine or a compound supplying iodine in an amount such that an iodine concentration in the ship ballast water is 0.1 to 100 mg/L.

For the reasons stated, Claims 10-28 are in condition for allowance. Early notice of allowance is requested.

Respectfully submitted,

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